

**APPLICATION AND INSTALLATION
HANDBOOK
FOR
DLC SERIES AC LINE CONDITIONERS**

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Manual #

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MANUFACTURER OF DELTEC PRODUCTS
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1.0 INTRODUCTION

PURPOSE: This handbook is intended to acquaint users of Deltec AC Line Conditioners (DLC) with their purposes, as well as with recommended installation techniques and precautions that will ensure optimum performance.

1.1 AC LINE CONDITIONERS (DLC)

WHAT THEY DO:

The line conditioner provides both common mode noise rejection as well as normal mode noise rejection. In addition, they provide output voltage regulation for changing input voltage due to brownouts or other voltages excursions.

WHAT THEY DO NOT DO:

DLCs do not contain batteries nor power inversion circuits and therefore cannot act as uninterruptible power sources. Further, they do not regulate nor control line frequency, and in fact, must have a source of power whose frequency does not vary greatly from the nominal value.

2.0 SPECIFICATIONS AND SCHEMATICS

2.1 AC LINE CONDITIONERS SPECIFICATIONS

INPUT

Voltage:	95-130 VAC (1) 190-270 VAC available
Frequency:	60Hz $\pm$ 2 Hz (1) 50Hz available

OUTPUT

Voltage:	120 VAC $\pm$ 2 VAC (1) 220-240 VAC available
Frequency:	Same as Input
Regulation:	$\pm$ 3% of nominal output
Waveform:	Sine Wave
Harmonic Distortion:	Less than 5%, nominal line 25% to full load
Power Factor:	0.75 lag to unity

PAGE 2

2.1 OUTPUT (continued)

Response Time:	50 Msec to within + 3% of nominal output. 16 Msec to within + 8% of nominal output.
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Overload Recovery:	Automatic, within 50 Msec
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Protection:	Current Limiting
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Efficiency:	80% minimum typically 88%
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ISOLATION

Common-Mode Rejection:	Greater than 120 dB, 1KHz to 1 MHz
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Input-to-Output Capacitance:	Less than .005 pf
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Transverse Mode Rejection:	Greater than 60 dB, 10KHz to 1 MHz
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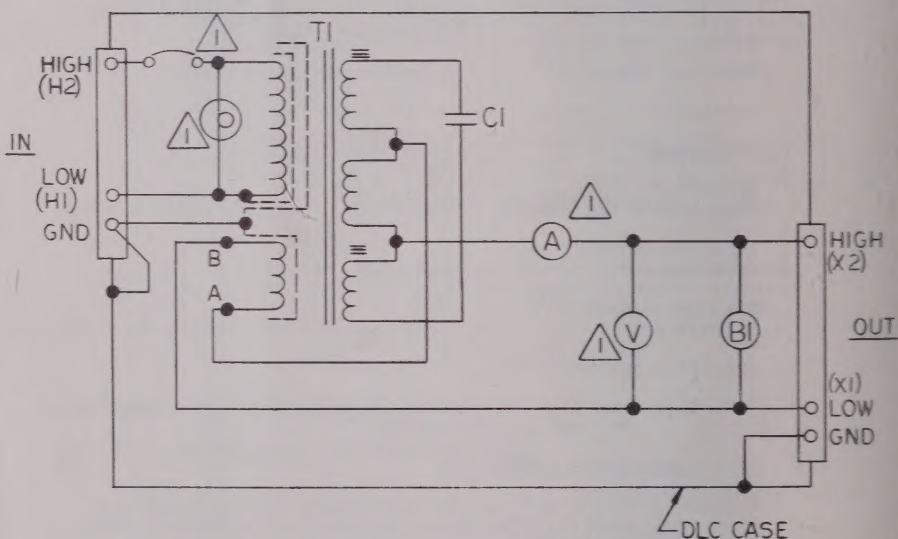
Operating Temperature:	0°C to 40°C
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NOTE (1): See line conditioner nameplate for your specific voltage and frequency.

2.2 LINE CONDITIONER SCHEMATICS

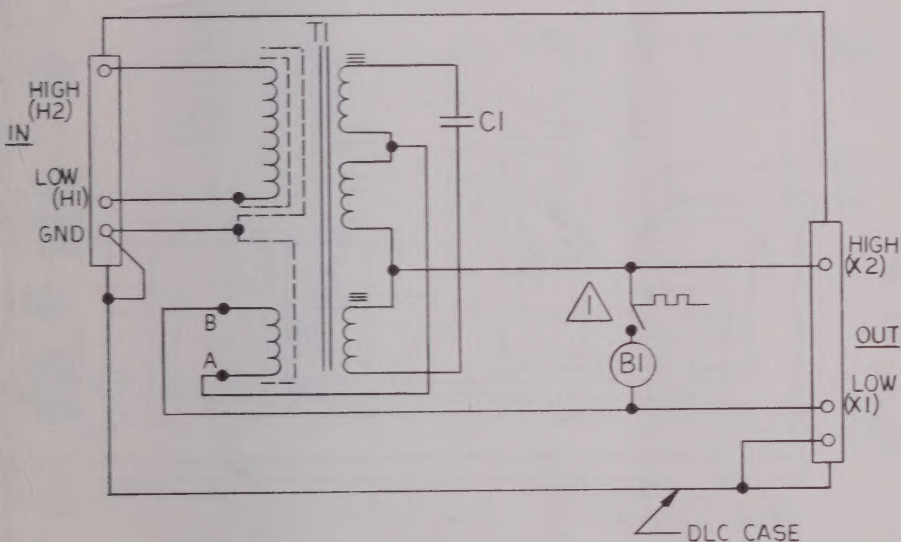
Figures 1 thru 4 are typical schematics for single phase line conditioners. The device consists of a ferroresonant transformer (T1), and capacitor C1. The filter action is incorporated in the transformer design and capacitor C1. The transformer action combined with C1 and the A-B winding provide regulation. Noise isolation is provided by the use of box shields on the primary and on the compensation winding (A-B) as well as the use of a faraday shield.

Three single phase DLCs can be connected in 3-phase configurations. Depending upon the primary of each DLC, the input may be configured as a four-wire wye input or a three-wire delta input. The output however, must be connected in a four-wire wye configuration in all instances.



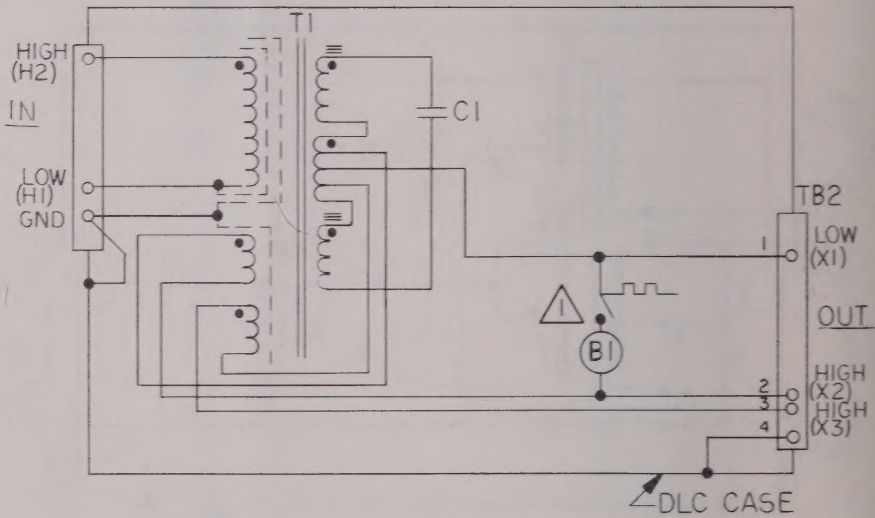
△ NOT INCLUDED IN A MODELS

FIGURE 1
SCHEMATIC-DLC,
1.2 KVA THRU 5 KVA



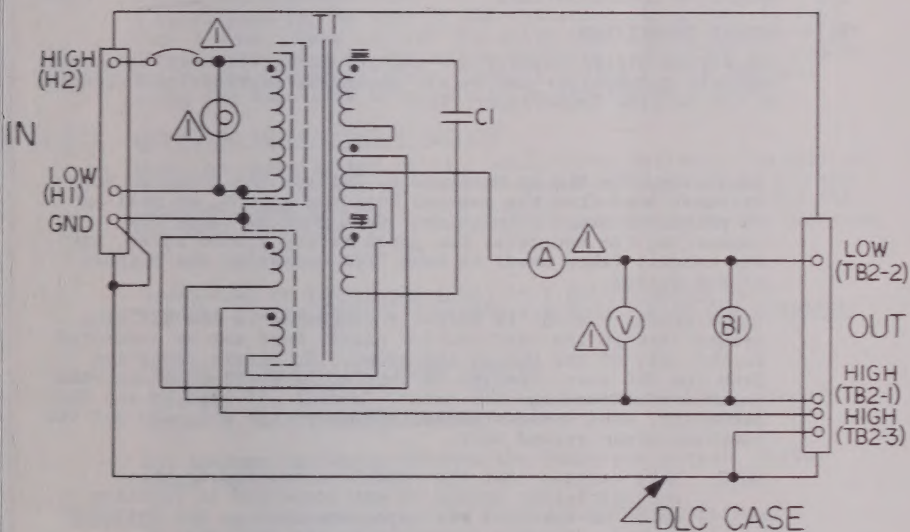
⚠ THERMAL SWITCH REMOVED IN LATEST MODELS,
FAN RUNS CONTINUOUSLY.

FIGURE 2
SCHEMATIC-DLC
7.5 KVA THRU 30 KVA 1Ø



⚠ THERMAL SWITCH REMOVED IN LATEST MODELS,
FAN RUNS CONTINUOUSLY.

FIGURE 3
SCHEMATIC-DLC
7.5 KVA THRU 30 KVA 1Ø
CENTER TAPPED



△ NOT INCLUDED IN A MODELS

FIGURE 4
SCHEMATIC DLC
1.2 KVA THRU 5 KVA
CENTER TAPPED

4.1 LOAD BALANCING THREE PHASE DLC'S

The characteristics of the DLC are such that the loads on each phase must be balanced to within plus or minus 10%. This requires the user to move the loads from phase to phase to obtain the necessary balance. If the loads are not balanced, the line-to-line voltage could be 208 VAC, 195 VAC & 220 VAC for a 120/208 VAC output.

4.2 CIRCUIT BREAKERS AND WIRING OF SINGLE PHASE DLC'S

The following paragraphs provide the recommended hookup of the single phase DLCs. Also included are methods to calculate the input and output current to properly size the circuit breakers and interconnecting wiring.

Slow trip circuit breakers are recommended and must be sized for voltage and current.

Use the following equation to calculate the current. Select a standard circuit breaker that is the closest above the current calculation.

$$\text{Output Current} = \frac{\text{Rated Output VA}}{\text{Output Voltage}}$$

$$\text{Input Current} = \frac{1.6 \times \text{Rated Output VA}}{\text{Input Voltage}}$$

(The input current equation takes into account a brownout input voltage with the DLC operating at full load.)

Wiring to be sized based upon the circuit breakers used per the National Electric Code or local codes.

4.2.1 WIRING A SINGLE PHASE DLC

Connect as shown in Figures 5 or 8 for units 5KVA or lower. See Figures 6 or 7 for 7.5KVA units and higher.

4.3 CIRCUIT BREAKERS AND WIRING OF THE THREE PHASE DLC'S

The following paragraphs provide the recommended hookups of three phase DLCs. Also included are methods to calculate the input and output current to properly size the circuit breakers and interconnecting wiring.

Slow trip circuit breakers are recommended and must be sized for voltage and current. Use the following equations to calculate the current and select the standard circuit breaker the closest above the current calculations.

$$\begin{aligned} \text{Output Current/Phase} &= \frac{\text{Rated three phase output VA}}{3 \times \text{line to neutral output voltage}} \\ &= \text{_____} \text{ amps/phase} \end{aligned}$$

$$\begin{aligned} \text{Input Current/Phase} &= \frac{1.6 \times \text{rated three phase output VA}}{1.73 \times \text{line-to-line input voltage}} \\ &= \text{_____} \text{ amps/phase} \end{aligned}$$

The input current equation takes into account a brownout input voltage with the DLC operating at full load.

Wiring to be sized based upon the circuit breakers used per the National Electric Code or local codes.

4.3.1 FACTORY WIRED 3Ø SYSTEM

Wire the three phase DLC as shown in Figure 9 (wye input/wye output) or 9A (delta input/wye output).

4.3.2 CUSTOMER WIRED SYSTEM

Wire the individual single phase DLCs into a three phase configuration as shown in Figure 10 (wye input/wye output) or 10A (delta input/wye output).

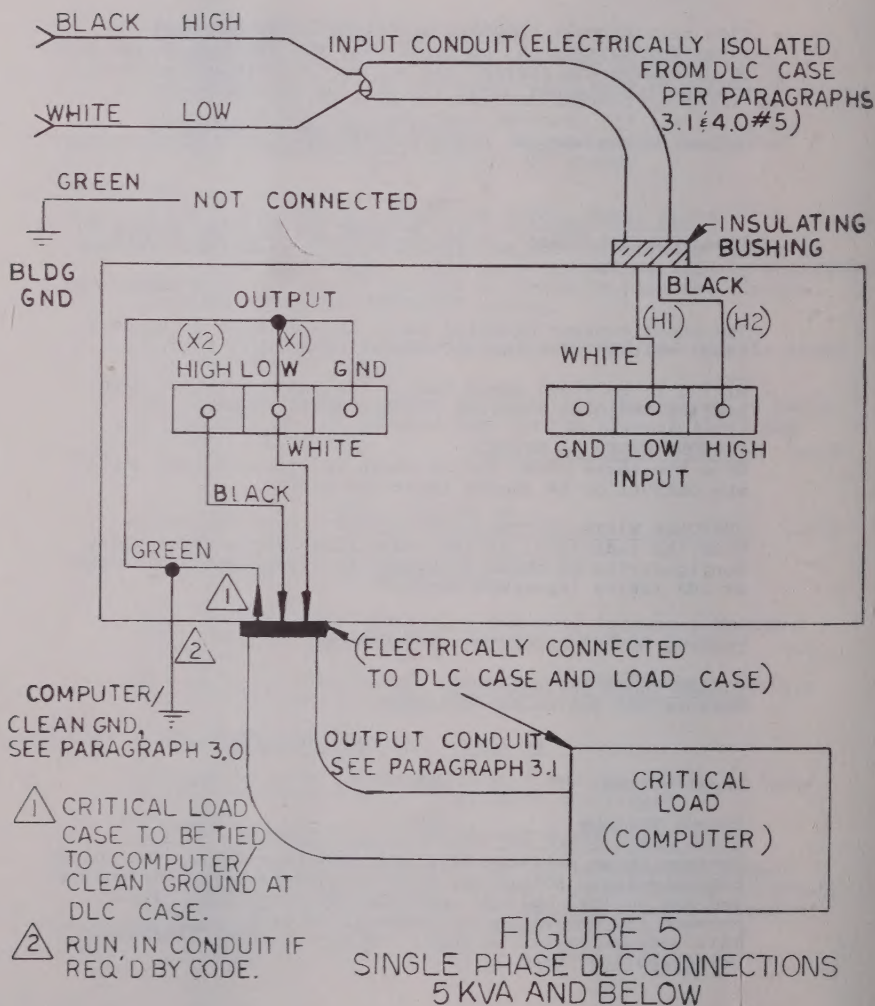
5.0 TESTING OF THE COMPLETED INSTALLATION

5.1 SINGLE PHASE INSTALLATION

Measure the following voltages:

	<u>NO LOAD</u>	<u>FULL LOAD</u>
Input Voltage	_____ VAC	_____ VAC
Output Voltage	_____ VAC	_____ VAC

Compare these voltages with the nameplate data. The loaded output voltage should not be more than 3% below the nominal and the no-load voltage more than 3% above the nominal. Measure the output white (neutral) to case _____. This voltage should be zero. If not, recheck grounding, paragraph 4.0, item 7.



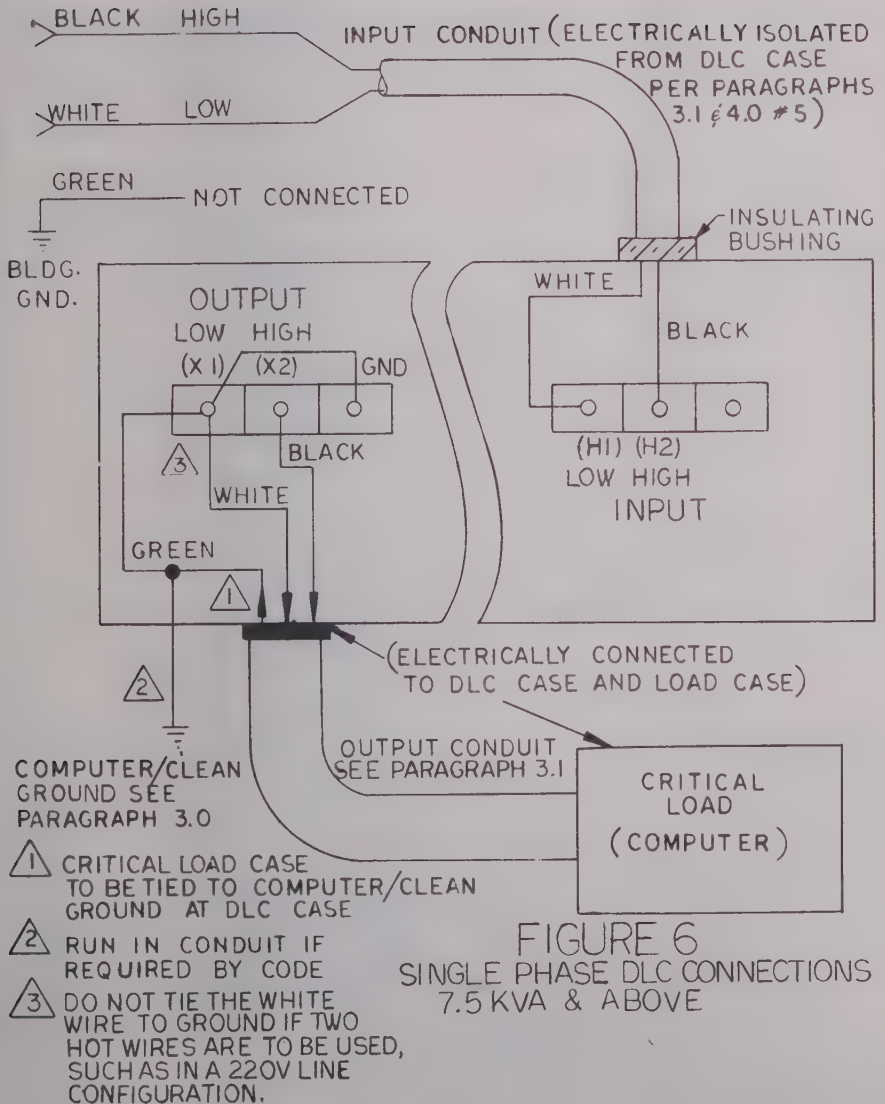


FIGURE 6
SINGLE PHASE DLC CONNECTIONS
7.5 KVA & ABOVE

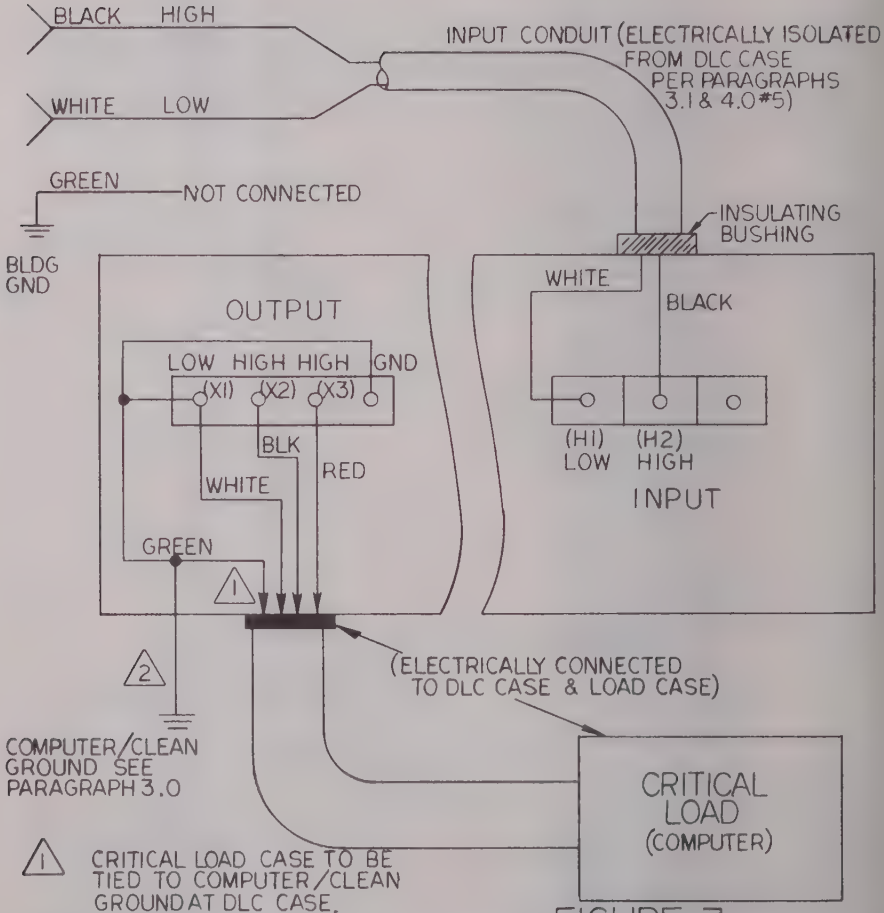
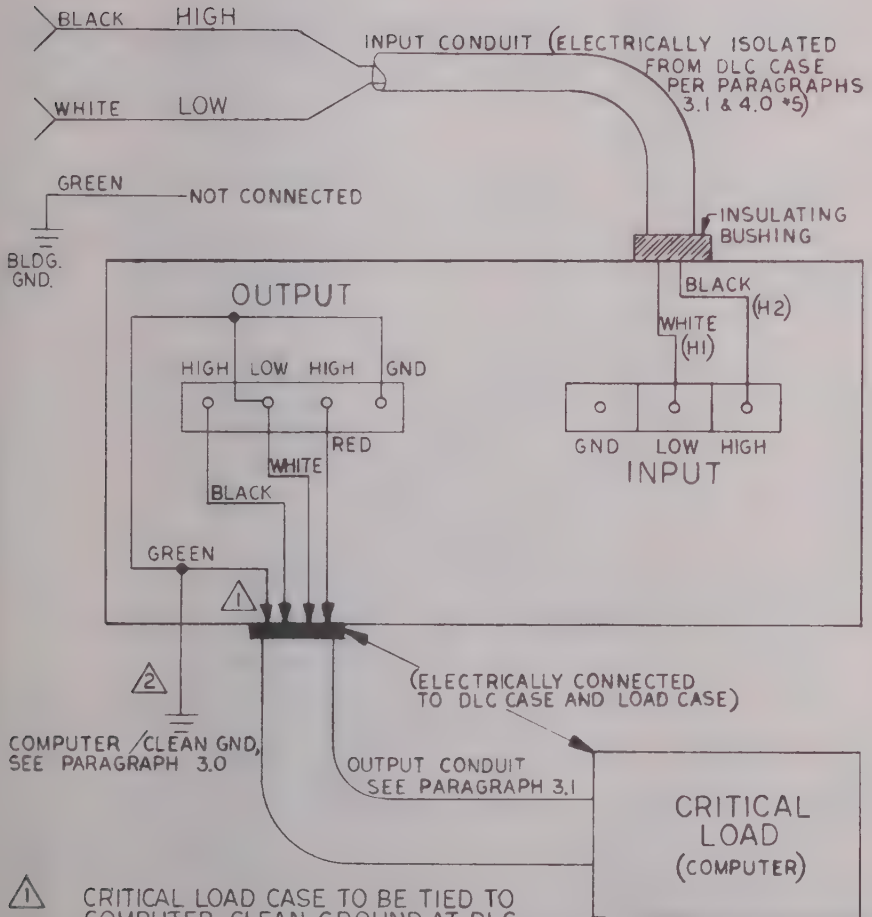


FIGURE 7
SINGLE PHASE CONNECTIONS
CENTER TAPPED OUTPUT 7.5
KVA & ABOVE.



1 CRITICAL LOAD CASE TO BE TIED TO COMPUTER CLEAN GROUND AT DLC CASE

2 RUN IN CONDUIT IF REQUIRED BY CODE.

FIGURE 8
SINGLE PHASE DLC
CONNECTIONS CENTER
TAPPED OUTPUT 5 KVA
& UNDER

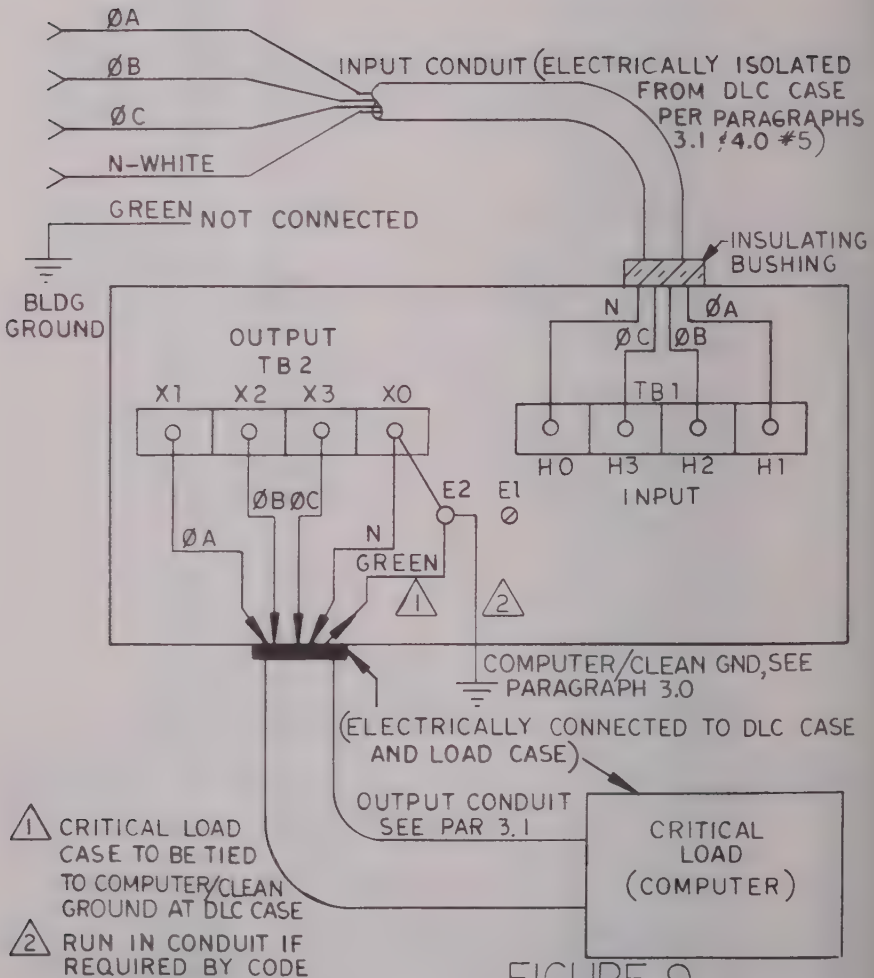


FIGURE 9
THREE PHASE DLC CONNECTIONS
OF A SINGLE 3 PHASE UNIT

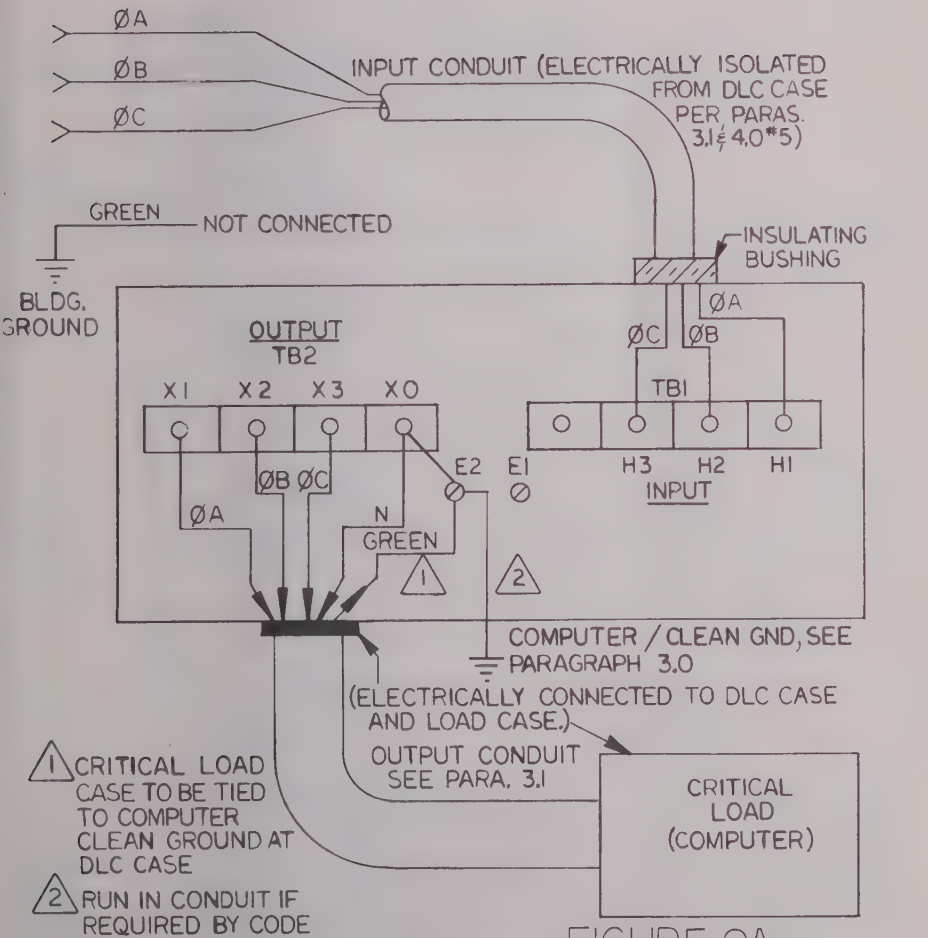


FIGURE 9A
THREE PHASE DLC CONNECTIONS
OF A SINGLE 3 PHASE UNIT
 (DELTA INPUT/WYE OUTPUT)

INPUT CONDUIT TO BE
ISOLATED FROM ALL
DLC CASES PER PARA.
3.1 & 4.0 #5

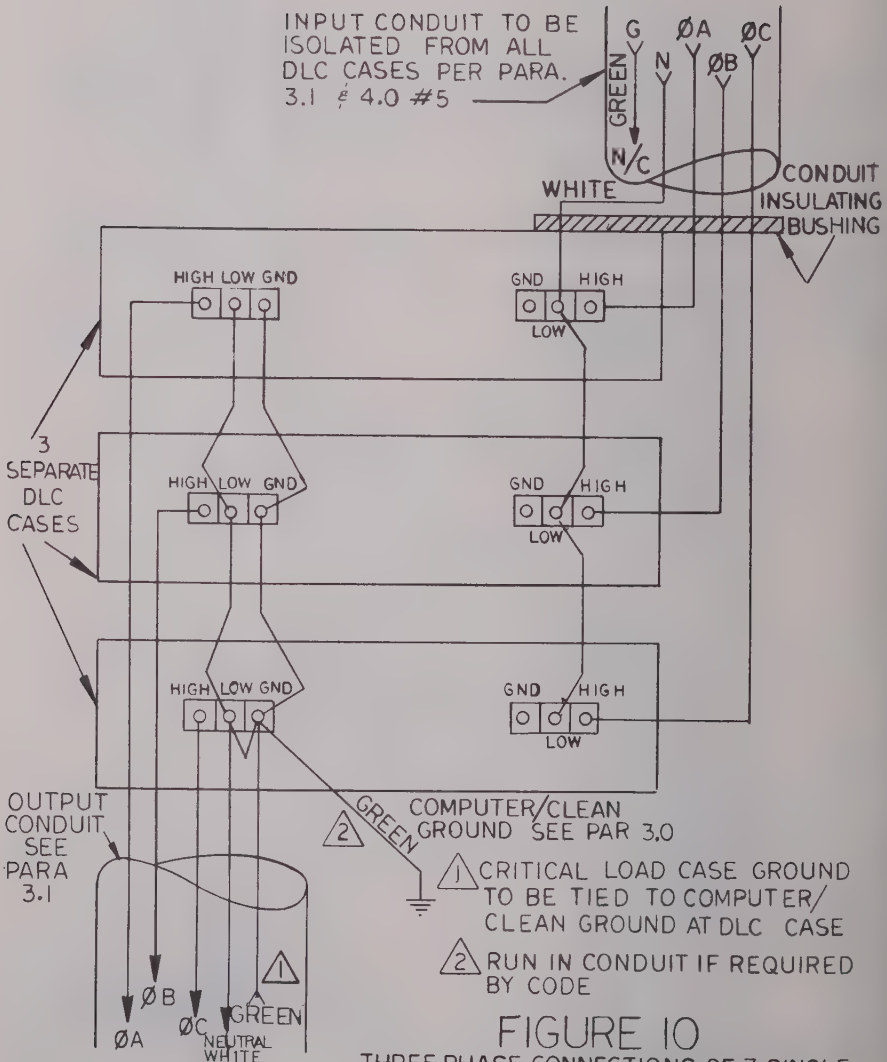
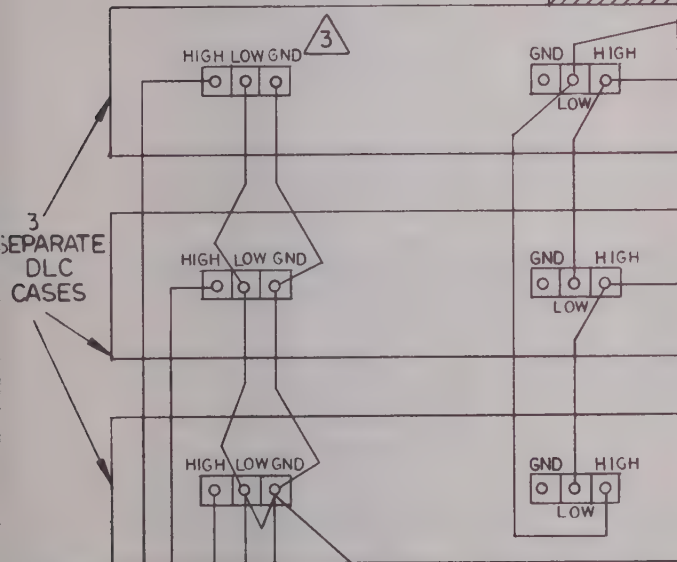
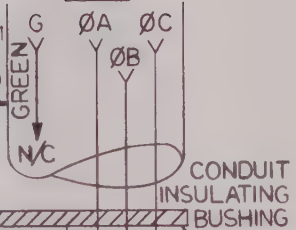


FIGURE 10
THREE PHASE CONNECTIONS OF 3 SINGLE
PHASE DLC UNITS 5KVA AND BELOW
WYE INPUT/WYE OUTPUT

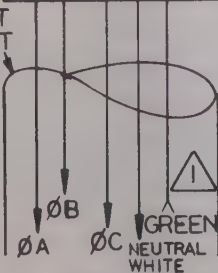
3 7.5KVA UNITS AND ABOVE
 TERMINAL DESIGNATORS
 ARE: HI=H2 (INPUT)
 LO=H1 (INPUT)
 HI=X2 (OUTPUT)
 LO=X1 (OUTPUT)

INPUT CONDUIT TO
 BE ISOLATED FROM
 ALL DLC CASES
 PER PARA. 3.1 AND
 4.0 #5

INPUT



OUTPUT
 CONDUIT
 SEE
 PARA.
 3.1



OUTPUT

GREEN

COMPUTER CLEAN
 GROUND SEE PAR 3.0

- 1 CRITICAL LOAD CASE GROUND
 TO BE TIED TO COMPUTER
 CLEAN GROUND AT DLC CASE
- 2 RUN IN CONDUIT IF REQUIRED
 BY CODE

FIGURE 10A

THREE PHASE CONNECTIONS OF 3 SINGLE
 PHASE DLC UNITS 5KVA & BELOW
 DELTA INPUT/WYE OUTPUT

5.2 THREE PHASE INSTALLATION

Measure the following voltages:

	<u>NO LOAD</u>	<u>FULL LOAD</u>
Input Voltage	_____ Ø A to Ø B	_____
Line-to-Line	_____ Ø B to Ø C	_____
	_____ Ø C to Ø A	_____
Output Voltage	_____ Ø A to Neutral	_____
Line to Neutral	_____ Ø B to Neutral	_____
	_____ Ø C to Neutral	_____
Output Voltage	_____ Ø A to Ø B	_____
Line-to-Line	_____ Ø B to Ø C	_____
	_____ Ø C to Ø A	_____

Compare these voltages with the nameplate data. The loaded output voltage should not be more than 3% below the nominal and the no-load voltage more than 3% above the nominal.

If the output line-to-line voltages are not within 5% of each other and if the line-to-neutral voltages are within +3% of each other, the common cause is that the loads are not balanced as indicated in paragraph 4.1.

Measure the output neutral to case _____. This voltage should be zero. If it isn't, recheck the grounding, paragraph 4.0, item 7.

6.0 MAINTENANCE AND TROUBLESHOOTING OF DLC'S

Basically, there is very little maintenance required. However, a periodic check to assure the connections are tight and removing any buildup of dust is required to assure continuous operation.

6.1 FAN MAINTENANCE

On the front panel of DLCs 1 KVA thru 5 KVA, there are four-inch muffin fans that require maintenance at least every 60 days and more often if they are in a dusty environment.

To clean the fan filter, remove the front screen by snapping off with a screwdriver. Next, remove the silver colored filter just behind the screen. Clean both filter and screen in soapy water and replace.

6.2 TROUBLESHOOTING DLC'S

- A. Nominal Voltage "Too High"
 - 1. The load may be considerably less than full rating.
 - 2. The load may have a leading power factor.
- B. Nominal Voltage "Too Low"
 - 1. Load power factor may be lagging.
 - 2. Unit may be slightly overloaded.
- C. Does Not Regulate Closely
 - 1. Unit may be slightly overloaded.
 - 2. Actual line voltage swings may be outside the rated coverage of unit, particularly on low side.
 - 3. On varying loads, load regulation may be mixed with the line voltage regulating action due to loading the line.
- D. Output Voltage "Very Low" (20-60V)
 - 1. Unsuspected or unplanned overloads may occur intermittently (motor-starting currents, solenoid inrush currents, etc.)
 - 2. One or more capacitors in the transformer may be defective. This could be a shorted capacitor or possibly a loose connection.
 - 3. Phasing incorrect in 3Ø units.
- E. No Output Voltage
 - 1. Check input power.
 - 2. Check primary circuit breaker.
 - 3. Check continuity between input terminals, and also between output terminals. (Power Off).
- F. In Case the DLC is Operating, but does not appear to have Correct Output, apply the following test:
 - 1. Disconnect the working load.

2. Connect a dummy load of lamps, heaters, or other resistive load substantially equal to the full load rating of transformer, directly across its output terminals.
3. Measure the output voltage using a dynamometer type voltmeter directly across its output terminals.

This test will usually establish whether the apparent poor performance is due to a fault in the DLC or to some peculiarity of the working load.

G. Transformer Operating Temperature

These transformers are designed to operate at high flux density, and hence, relatively high temperatures. After connection to line for a half hour or so, the cabinet could be warm to the touch. However, if there is any indication of oil leakage, consult the factory.

H. Voltage Present Between Output Neutral and Case

This voltage is due to distributed capacitance between the DLC output winding and the chassis. The voltage being read is a function of the source impedance of the voltmeter. There will be no damage to the DLC if the low side of the DLC is connected to chassis as indicated in the wiring instructions. The DLCs are shipped with this winding floating with respect to the case so the user can connect the low side to the desired ground point.

7.0 OUTLINE DRAWINGS

This section provides the overall outline and mounting information for each model.

7.1 SINGLE PHASE DLC'S

MODEL NUMBER	POWER VA	CIRCUIT BREAKER	METERS	H	W	D
DLC 1260	1200	Yes	Yes	7	17	14½
DLC 1260A	1200	No	No	7	17	14½
DLC 1262	1200	Yes	Yes	7	17	14½
DLC 1262A	1200	No	No	7	17	14½
DLC 1860	1800	Yes	Yes	8 3/4	17	20
DLC 1860A	1800	No	No	8 3/4	17	20
DLC 1862	1800	Yes	Yes	8 3/4	17	20
DLC 1862A	1800	No	No	8 3/4	17	20
DLC 3060	3000	Yes	Yes	14	17	20
DLC 3060A	3000	No	No	14	17	20
DLC 3062	3000	Yes	Yes	14	17	20
DLC 3062A	3000	No	No	14	17	20
DLC 5060	5000	Yes	Yes	14	17	20
DLC 5060A	5000	No	No	14	17	20
DLC 5062	5000	Yes	Yes	14	17	20
DLC 5062A	5000	No	No	14	17	20
DLC 7560A	7500	No	No	26	30	19
DLC 10060A	10,000	No	No	26	30	19
DLC 15060A	15,000	No	No	26	30	19
DLC 20060A	20,000	No	No	32	36	22

7.2 THREE PHASE DLC'S

MODEL NUMBER	POWER VA	CIRCUIT BREAKER	METERS	H	W	D
DLC 15060A-3	15 KVA	No	No	61	24	32

WARRANTY

Gould, Inc., Power Conversion Division, Manufacturer of Deltec Products, warrants each equipment manufactured by them, when properly applied and operated under normal conditions, against failure due to faulty materials or workmanship for a period of one year from the date of original shipment from the factory. The warranty covers repair or replacement of defective parts at the Deltec factory, provided the equipment has been returned by the user via pre-paid freight and only after receiving authorization from the Customer Service Department to return such equipment. Should in-field warranty repair be requested by the customer, actual travel expenses will be borne by the customer. Deltec products repaired or replaced pursuant to this warranty shall be warranted for the unexpired portion of the warranty applying to the original product.

Excepted from this warranty are batteries and equipment which has been abused or operated outside the limits of its electrical or environmental specification. When field tests suggest that the Deltec equipment may be faulty, whether in or out of the warranty period, a full report of the difficulty should be sent to the company address listed below. Upon receipt of this report, the Customer Service Department may suggest other disposition of the faulty equipment.

Deltec will not be liable for any associated costs incurred by the user, installing contractor, or wholesaler as a direct or indirect result of failure or in the replacement of defective, in-warranty material unless prior approval has been granted by Deltec. Unauthorized returns of units for in-warranty repairs which are found to be defective will be subject to an inspection and handling charge of \$100 plus all repair and transportation charges.

Equipment repaired beyond the effective date of the warranty or when abnormal usage has occurred will be charged at applicable rates and the user will be advised of the estimate of such charges before Deltec commences repair. When ordering replacement parts, specify: (1) Model number of the equipment and serial number, (2) Part number, description and quantity required, (3) Date of purchase of original equipment, and (4) Any special shipping or quotation instructions.

Any technical advice furnished before or after delivery in regard to use or application of Deltec's equipment is furnished without charge and on the basis that it represents Deltec's best judgement under the circumstances, but it is used at the recipient's sole risk.

This warranty is in lieu of all other warranties, expressed or implied, including suitability for specific use, total life expectancy or any other obligation or liability on the part of Deltec.

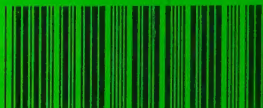
Correspondence concerning the above warranty should be addressed to:

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